**REMARKS/ARGUMENTS**

Reconsideration and withdrawal of the rejections of the application are respectfully requested in view of the amendments and remarks herewith, which place the application into condition for allowance. The present amendment is being made to facilitate prosecution of the application.

## I. STATUS OF THE CLAIMS AND FORMAL MATTERS

Claims 1-16 are pending in this application. Claims 1, 6, 11-13, and 15 are independent and hereby amended. No new matter has been added. It is submitted that these claims, as originally presented, were in full compliance with the requirements of 35 U.S.C. §112. Changes to claims are not made for the purpose of patentability within the meaning of 35 U.S.C. §101, §102, §103, or §112. Rather, these changes are made simply for clarification and to round out the scope of protection to which Applicants are entitled.

## II. SUPPORT FOR AMENDMENT IN SPECIFICATION

Support for this amendment is provided throughout the Specification as originally filed and specifically at paragraphs [0149]-[0159] and figures 15A, 17A, 19B, 20, 21A and 21B of Applicants' corresponding published application. By way of example and not limitation:

> [0149] In this robot 1, safe space is set to each position where a touch sensor 64 detects a safety level status.
>
> [0150] The "volume" of safe space, on the other hand, is a barometer representing the size of the safe space in a fixed quantity manner. In this embodiment, as to safe space formed by a single joint mechanism, as shown in FIG. 15A, the volume of a column 75 which contacts with two links being connected to each other via the joint mechanism on the bending sides of the two links and of which the central axis is orthogonal to the two links is defined as "volume".

[0151] Further, in this embodiment, as to safe space formed by two links being connected via one or plural links, as shown in FIG. 17A, the volume of a column 76 which contacts with the inside of the two links at a position where a distance between the two links is the shortest is defined as "volume". Furthermore, as safe space formed by the robot 1 and surroundings, as shown in FIG. 19B, the volume of a sphere 77 with the robot 1 as a center and with a distance between the robot 1 and the obstacle as a diameter is defined as "volume".

[0152] Note that these definitions of "volume" of safe space are just examples and such definitions that the above volumes are approximated by size and angle can be applied, provided that the volume of safe space can be represented in a fixed quantity manner.

[0153] Consider a case of safe space formed by the first and second links 82A and 82B being connected to each other via one joint mechanism 81 as shown in FIG. 20. **With the above-described definitions of the "volume" of safe space in this embodiment, by assuming that a cross-sectional area of the first and second links 82A and 82B is a square, the "volume" of this safe space can be calculated as the area of a circle (hereinafter, referred to as safe space definition circle) SSC.sub.1 which contacts with the first and second links 82A and 82B on the bending side of the joint mechanism 81.**

[0154] In this case, assume that the current angle is ".theta." with the initial angle of the joint mechanism 81 as "0", the radius of the circle is r, the distance from the rotational center J of the joint mechanism 81 to the position of the touch sensor 63 (to each of the bottoms $H_1$ and $H_2$ of perpendiculars drawn from the center O of the circle toward the central lines $K_1$ and $K_2$ of the first and second links 82A, 82B) is d. An angle theta$_k$ between the first and second links 82A and 82B is derived from the following equation (1).

.theta..sub.k=.pi.-.theta. (1)

[0155] Since the center O of the safe space definition circle SSC.sub.1 exists on the bisector of the interior angle .theta..sub.k and exists on a line passing a contacting point of the first or second link 82A and 82B and the safe space definition circle SSC out of normal of the first and second links 82A and 82B, the radius r.sub.1 of the safe space definition circle $SSC_1$ is derived from the following equation (2). 1 r = d tan [ k 2 ] ( 2 )

[0156] Therefore, the size a of the safe space definition circle SSC.sub.1 of this case is calculated by the following equation (3) as an area depending on the output angle of the joint mechanism 81. 2 a = [ d tan [ - 2 ] ] 2 ( 3 )

[0157] Similarly, as shown in FIG. 21A, considering safe space corresponding to the first and second links 83A and 83B being connected via a plurality of joint mechanisms 84A and 84B. **The volume of this safe space can be calculated as the size of a safe space definition circle SSC.sub.2 which contacts with the first and second links 83A and 83C.** This size of the safe space definition circle SSC.sub.2 can be calculated based on the reflective indexes of the joint mechanisms 84A and 84B and the shapes of the links 83A to 83C.

[0158] In addition, as shown in FIG. 21B, **the volume of safe space between**

**the robot 1 and surroundings is calculated as the size of a safe space definition circle SSC.sub.3 with a distance between the robot 1 and an obstacle as a radius and with the robot 1 as a center.** Then this size of the safe space definition circle $SSC_3$ can be calculated based on the distance from the robot 1 to the obstacle.

[0159] As described above, in step SP31 of the safety level determination procedure RT4, the volume of corresponding safe space is calculated based on the angle signals $S2C_1$ to $S2C_{17}$ given from the potential meters $P_1$ to $P_{17}$, information on the shape of each link (upper arm block 15, forearm block 16 and hand block 17 of each arm unit 5A, 5B, body unit 2, and thigh block 30 and shin block 31 of each leg unit 6A, 6B) being stored in the external memory 66, and/or the state signal S10 given from the state recognition unit 70.

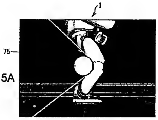


FIG. 15A

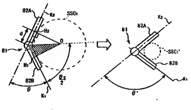

FIG. 20

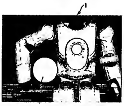


FIG. 17A

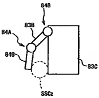


FIG. 21A

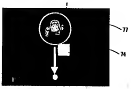


FIG. 19B

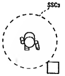


FIG. 21B

## III. RESPONSE TO REJECTIONS UNDER 35 U.S.C. §102(e) and §103(a)

Claims 1, 3, 6, 8, 11-13 and 15 were rejected under 35 U.S.C. §102(e) as allegedly anticipated by U.S. Patent No. 6,330,494 to Yamamoto (hereinafter, merely "Yamamoto").

Claims 2, 7, 14, and 16 were rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Yamamoto in view of U.S. Patent No. 6,902,015 to Furuta, et al. (hereinafter, merely "Furuta").

Claims 4 and 9 were rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Yamamoto in view of U.S. Patent No. 6,463,356 to Hattori, et al. (hereinafter, merely "Hattori").

Claims 5 and 10 were rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Yamamoto in view of U.S. Patent No.5,349,277 to Takahashi, et al. (hereinafter, merely "Takahashi").

Claim 1 recites, *inter alia*:

> ...wherein the safety level is a volume calculated as a function of a joint angle, a capability of the joint angle, a timing of a potential risk, and a planned action, and **the volume is calculated as the area of one of a plurality of safe space definition circles,**
>
> **wherein the plurality of safe space definition circles include a safe space definition circle which contacts with a first link and a second link of one or more joint mechanisms, and a safe space definition circle which has a radius being a distance between the movable robot apparatus and an obstacle and a center being the movable robot apparatus...** (Emphasis added)

Applicants submit that Yamamoto fails to disclose or render predictable the above-identified features of claim 1. Specifically, Yamamoto does not disclose or render

predictable "**the volume is calculated as the area of one of a plurality of safe space definition circles, wherein the plurality of safe space definition circles include a safe space definition circle which contacts with a first link and a second link of one or more joint mechanisms, and a safe space definition circle which has a radius being a distance between the movable robot apparatus and an obstacle and a center being the movable robot apparatus,**" as recited in claim 1.

Specifically, the Office Action (see page 3) asserts that Yamamoto describes that the safety level is a volume calculated as a function of a joint angle, a capability of the joint angle, a timing of a potential risk, and a planned action, and refers to Yamamoto, col.7 line 35-col.9 line 20, which are reproduced as follow:

> *Yamamoto, col.7 line 35-col.9 line 20:*
> FIG. 9 is a flow chart illustrating an algorithm for determining the presence of a falling posture by means of the control section 100 of the multi-legged walkable robot 1.
>
> Referring to FIG. 9, **the control section 100 detects any falling posture on the basis of the acceleration information AccXt, AccYt, AccZt along the three axis (x, y, z) detected by the acceleration sensor 41 in a manner as described below.**
>
> For determining the presence of a falling posture, in Step S11, the control section 100 discards the oldest acceleration information AccXn, AccYn, AccZn in the data buffer and updates the time tag of the data in the data buffer. In the multi-legged walkable robot 1, the buffer number of the data buffer is 50 for each of the three axes.
>
> ... ...
>
> In Step S15, it is determined if the average acceleration (Euclidian distance) Acc is found within the tolerable range (.DELTA.Acc) or not. If the average acceleration Acc is not found within the tolerable range, the control section 100 moves out of the falling

> posture determining process because the robot may be subjected to a large external force, trying to lift it.
>
> Then, in Step S16, the control section 100 compares the argument .theta. of the average acceleration Acc and the Y-Z plane and the angle .PHI. of the component of the average acceleration projected on the Y-Z plane and the Z-axis with the template argument .theta.m of the average acceleration Ace and the Y-Z plane and the template angle .PHI.m of the component of the average acceleration projected on the Y-Z plane and the Z-axis that are template data for the current posture. If the differences are within the respective tolerable ranges (.DELTA..theta.m, .DELTA..PHI.m), the control section 100 determines that the current posture is normal. If, on the other hand, the differences are out of the respective tolerable ranges, it determines that the robot is falling or in an abnormal posture. When, the robot is walking, .theta.=-.pi./2 and .PHI.=arbitrary.
>
> Since a falling phenomenon is a very low frequency phenomenon relative to the sampling frequency of angular velocity, the use of data buffer for determining averages over a period of time can reduce the possibility of errors due to noises in determining a falling posture. Additionally, this technique provides the advantage of a low load if compared with the use of a low pass digital filter for processing data.
>
> … …

Yamamoto describes that **the control section detects any falling posture on the basis of the acceleration information AccXt, AccYt, AccZt along the three axis (x, y, z) detected by the acceleration sensor**. Thus, nothing has been found in Yamamoto that disclose or render predictable "the volume is calculated as the area of one of a plurality of safe space definition circles, wherein the plurality of safe space definition circles include a safe space definition circle which contacts with a first link and a second link of one or more joint mechanisms, and a safe space definition circle which has a radius being a distance between the

movable robot apparatus and an obstacle and a center being the movable robot apparatus," as recited in claim 1.

Therefore, Applicants submit that independent claim 1 is patentable and respectfully request reconsideration and withdrawal of the rejection.

For reasons similar to, or somewhat similar to, those described above with regard to independent claim 1, independent claims 6, 11-13 and 15 are also patentable, and Applicants thus respectfully request reconsideration of the rejections thereto.

## IV. DEPENDENT CLAIMS

The other claims in this application are each dependent from one of the independent claims discussed above and are therefore believed patentable for at least the same reasons. Applicants thereby respectfully request reconsideration and withdrawal of rejections thereto. Because each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

## CONCLUSION

Because Applicants maintain that all claims are allowable for at least the reasons presented hereinabove, in the interests of brevity, this response does not comment on each and every comment made by the Examiner in the Office Action. This should not be taken as acquiescence of the substance of those comments, and Applicants reserve the right to address such comments.

In the event the Examiner disagrees with any of statements appearing above with respect to the disclosure in the cited reference, or references, it is respectfully requested that the Examiner specifically indicate those portions of the reference, or references, providing the basis for a contrary view.

Please charge any additional fees that may be needed, and credit any overpayment, to our Deposit Account No. 50-0320.

In view of the foregoing amendments and remarks, it is believed that all of the claims in this application are patentable and Applicants respectfully request early passage to issue of the present application.

Respectfully submitted,

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